Approved for public release by the Director of the National Institute of Standards and Technology (NIST) on October 9, 2015.

NATIONAL BUREAU OF STANDARDS REPORT

NBS PROJECT 1002-12-10421 January 29, 1962

NBS REPORT 7425

Tenth Progress Report

on the

Mechanisms of Fire Ignition and Extinguishment

by

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Covering the period 1 February 1961 to 31 January 1962

for

Bureau of Ships
Department of the Navy
Code 638

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U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

1. Summary

It was planned to submit, in August 1961, a final report on the Langmuir probe work and such a report was written. Editorial revision has been more extensive than expected and the report is still not quite ready. After 1 July 1961, the project was inactive because of lack of funds. Financial support was received in October and the project reactivated as of December 1, 1961. It is planned to use these funds to finance the continued development of a new type of mass spectrometer which is considered important in the study of the mechanism of inhibition. Work was started on the instrument in 1959 under Order No. BuShips 170085?0, Index No. NS-183-001, but has more recently been supported by the National Bureau of Standards' funds. Development of the instrument has progressed to the point of its showing acceptable resolution. Present efforts are toward an increase in sensitivity and stability.

Previous work on inhibition has indicated a possible connection between dissociative resonance capture of electrons and the efficiencies of extinguishing agents. Some work was done, partly supported by this project and partly by the NBS, in the study of methods of measuring attachment coefficients and in the collection and assembly of apparatus.

2. The Mass Spectrometer

The mass spectrometer being developed operates on the principle of acceleration of the ions by a sawtooth voltage between the ends of field-free drift tubes. Inside the drift tube the velocities of the different ions produces a spread in both space and time of emergence from the exit end. Upon emergence, the ions are either accelerated or decelerated depending upon their phase with respect to the sawtooth voltage. Since phasing is involved, harmonies of the original time-of-flight are important, and it has been shown by the use of higher harmonies, that a resolution of one mass number at mass 40 is readily attained.

It is expected that the present design will have higher sensitivity than conventional mass spectrometers because of the presence of the smaller number of grids, each of which produces a loss of ions. The present sensitivity is such as to show the isotope of potassium, which is present in a concentration of 6% of the normal ions. This was accomplished with the use of a heated filament, on which potassium salts had been deposited. This source was unsatisfactory because of the potential difference between the ends of the filament, which produced an energy spread in the ions leaving the filament.

During December a unipotential, indirectly-heated source was designed, constructed and tested. Improvements have been made and it is hoped that a more satisfactory source is now available. It has been necessary to use a stable source of known ions in order to determine the other instrumental parameters which affect the sensitivity and stability, before using the instrument on flames.

3. Attachment of Electrons.

There is only a limited amount of information in the literature on the attachment of electrons by gases, and even less information on gases known to be inhibitors. A study was made of methods of measurement of the phenomena and apparatus was assembled. Since July this phase of the work has been continued with NBS funds. There is evidence that the method selected will permit the classification of compounds into attaching and non-attaching gases and also give information with regard to the energies of the electrons attached. It is not expected to give information on the mechanism of the attachment process but should serve to provide a first classification prior to the more concentrated mass spectrometric study.

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